GEJ-3856C

OPERATING MANUAL

DIESEL-ELECTRIC LOCOMOTIVE

GENERAL ELECTRIC

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These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

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GENERAL ELECTRIC COMPANY
TRANSPORTATION SYSTEMS BUSINESS DIVISION
ERIE, PA. 16501

GENERAL ELECTRIC

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GENERAL DATA

MODEL	U18B	U23B	U23C	U30B	U30C	U33B	U33C	U36B	U36C
HORSEPOWER	1800	2250	2250	3000	3000	3300	3300	3600	3600
TYPE (AAR SYMBOL)	B-b	B-B	C-C	B-B	C-C	B-B	C-C	B-B	C-C
MAJOR DIMENSIONS									
Over-all Length	54 ft 8 in.	60 ft 2 in.	67 ft 3 in.	60 ft 2 in.	67 ft 3 in.	60 ft 2 in.	67 ft 3 in.	60 ft 2 in.	67 ft 3 in.
Inside Knuckles	10 ft 3 3/4 in.	10 ft 3 1/4 in.	10 ft 3 1/4 in.	10 ft 3 1/4 in.	10 ft 3 1/4 in.	10 ft 3 1/4 in.	10 ft 3 1/4 in.	10 ft 3 1/4 in.	10 ft 3 1/4 in.
Over-all Width	14 ft 9 1/4 in.	14 ft 9 1/4 in.	15 ft 4 1/2 in.	14 ft 9 1/4 in.	15 ft 4 1/2 in.	14 ft 9 1/4 in.	15 ft 4 1/2 in.	14 ft 9 1/4 in.	15 ft 4 1/2 in.
Over-all Height Above Rail	30 ft 8 in.	36 ft 2 in.	40 ft 11 in.	36 ft 2 in.	40 ft 11 in.	36 ft 2 in.	40 ft 11 in.	36 ft 2 in.	40 ft 11 in.
Length between Center Plates	39 ft 8 in.	45 ft 6 in.	47 ft 10 1/2 in.	45 ft 6 in.	47 ft 10 1/2 in.	45 ft 6 in.	47 ft 10 1/2 in.	45 ft 6 in.	47 ft 10 1/2 in.
Total Wheel Base	*9 ft 0 in.	*9 ft 0 in.	13 ft 7 in.	*9 ft 0 in.	13 ft 7 in.	*9 ft 0 in.	13 ft 7 in.	*9 ft 0 in.	13 ft 7 in.
Truck Wheel Base (Floating Bolster Truck)									
DRIVE									
Traction Motors	Four GE-752	Four GE-752	Six GE-752	Four GE-752	Six GE-752	Four GE-752	Six GE-752	Four GE-752	Six GE-752
Wheel Diameter	40 in.	40 in.	40 in.	40 in.	40 in.	40 in.	40 in.	40 in.	40 in.
WEIGHT (TYPICAL)									
Total Weight	219,000 lb	242,000 lb	348,000 lb	254,800 lb	363,000 lb	256,000 lb	363,600 lb	257,000 lb	364,800 lb
Total on Drivers	219,000 lb	242,000 lb	348,000 lb	254,800 lb	363,000 lb	256,000 lb	363,600 lb	257,000 lb	364,800 lb
Per Axle	54,750 lb	60,500 lb	56,000 lb	63,700 lb	60,500 lb	64,000 lb	60,600 lb	64,250 lb	60,800 lb
SUPPLIES									
Fuel	1200 gal	1700 gal	3000 gal	1700 gal	3000 gal	1700 gal	3000 gal	1700 gal	3000 gal
Lubricating Oil	160 gal	300 gal	300 gal	380 gal	380 gal	380 gal	380 gal	380 gal	380 gal
Cooling Water	330 gal	350 gal	350 gal	350 gal	350 gal	350 gal	350 gal	350 gal	350 gal
Governor Oil	2 qt	2 qt	2 qt	2 qt	2 qt	2 qt	2 qt	2 qt	2 qt
Sand	60 cu ft	60 cu ft	60 cu ft	60 cu ft	60 cu ft	60 cu ft	60 cu ft	60 cu ft	60 cu ft
AIR BRAKES	26L	26L	26L	26L	26L	26L	26L	26L	26L

* NOTE: Corresponding dimensions for General Electric swing bolster (equalized) truck 9 ft. 4 in.

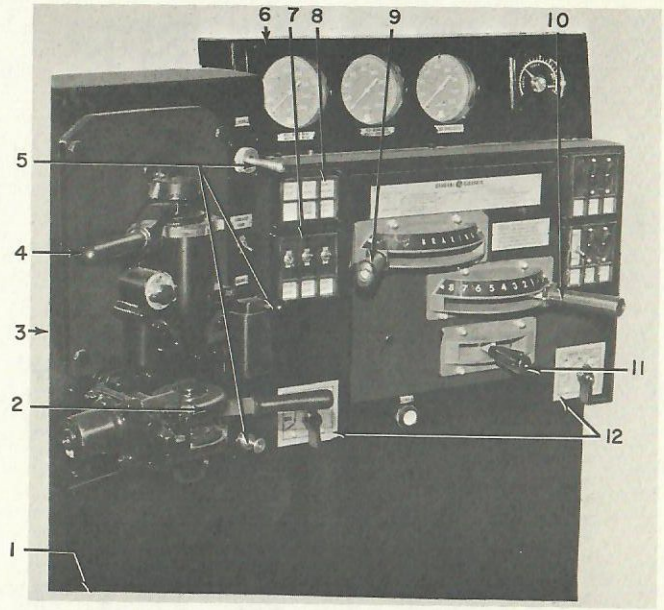


Fig. 1 (E-19096)

1 MU-2A valve (or two position cock)
2 Independent brake valve
3 Regulating valve
4 Automatic brake valve
5 Horn-bell and sander controls
6 Instrument panel
7 Switch panel
8 Indicating-light panel
9 Dynamic braking handle
10 Throttle handle
11 Reverse handle
12 Front and rear headlight switches

Fig. 1. Operator's position (with KC-108 controller)

INTRODUCTION

All of the operating devices, manual and visual, normally used by the engineman during locomotive operation are located near the operator's position. Most of these devices are located either on the control stand or on the engine control panel.

NOTE: Customer equipment requirements often differ from one railroad to another. Therefore, physical locations and appearance of some devices illustrated in this manual may not agree entirely with the equipment furnished to any particular railroad.

MASTER CONTROLLER
(See Figs. 1 and 2)

The master controller is a set-up switch used by the operator to control the locomotive. Two models of controller are described in this manual. Mounted on the control stand are various toggle switches, circuit breakers, indicating lights and instruments used by the operator. The independent and automatic brake valve handles and other frequently used air brake controls are also located on the control stand.

KC-108 CONTROLLER (Fig. 1)*

This controller has a Reverse Handle, Throttle Handle and Braking Handle.

*KC-108 is the General Electric designation for this model of controller. Its functional design has been approved by the AAR Committee on Locomotives and Electrical Equipment. It may be identified by the blue housings around the three handles.

Reverse Handle

The reverse handle, the bottom of the three handles, is used to determine the direction of locomotive travel. It has positions REVERSE, OFF and FORWARD. The handle is removable only when the throttle handle is in IDLE position and the braking handle is in OFF.

Throttle Handle

The throttle handle is above the reverse handle. It has a SHUTDOWN, IDLE, and eight major positions or notches for power.

The SHUTDOWN position is located to the right of IDLE and is used in an emergency to shut down all engines of a multiple-unit consist from the operator's position of the controlling unit.

To increase motoring power, the handle is moved clockwise toward the operator.

Braking Handle (Dynamic Braking)

The braking handle is above the throttle handle and has OFF and SET-UP positions and a BRAKING sector.

In the OFF position, nearest the operator, dynamic braking is shut off. The SET-UP position establishes dynamic braking circuits. Movement beyond this position into the BRAKING sector (counterclockwise away from the operator) increases braking effort.

Interlocking Between Handles

Interlocking between the handles of the master controller is provided as follows:

1. The reverse handle must be inserted before the throttle handle can be moved out of IDLE position.

2. The reverse handle can be moved into FORWARD or REVERSE only when the throttle handle is in IDLE position and the braking handle is in OFF position.

3. The reverse handle cannot be moved out of FORWARD or REVERSE position when either the throttle handle is advanced beyond IDLE or the braking handle is advanced beyond OFF.

4. The braking handle must be in OFF position before the throttle handle can be moved out of IDLE position.

5. The throttle handle must be in IDLE and the reverse handle in FORWARD or REVERSE before the braking handle can be moved.

6. The reverse handle can be removed when the braking handle is in OFF and the throttle handle is in IDLE.

Operation

To manipulate the controller operating handles during locomotive operation, proceed as follows:

Lead or Single-unit Operation

Operating Handle Set-up (Reverse Handle Removed)

1. Braking (top) handle in OFF.
2. Throttle (middle) handle in IDLE.

CAUTION: FINDING THE BRAKING HANDLE AWAY FROM OFF OR THE THROTTLE HANDLE AWAY FROM IDLE WITH THE REVERSE HANDLE REMOVED INDICATES THAT INTERLOCKING BETWEEN HANDLES REQUIRES REPAIR OR ADJUSTMENT. DO NOT ATTEMPT TO OPERATE.

3. Insert the reverse (bottom) handle.

4. Set the reverse handle for desired direction.

Operating in Power Mode

1. Braking handle remains in OFF.

2. Move the throttle handle to the desired notch.

Operation in Dynamic Brake Mode

1. Throttle handle returned to IDLE.

2. Move the braking handle to SET-UP, pause for several seconds, then advance as desired.

Operation as Trail Unit

1. Braking handle in OFF.

2. Throttle handle in IDLE.

3. Reverse handle centered and removed.

For Emergency Multiple-unit Shutdown

1. In the controlling unit, pull out on the throttle handle, and move it beyond IDLE to SHUTDOWN.

NOTE: In a trail unit the reverse handle must be inserted to release the throttle handle before it can be moved to SHUTDOWN.

OPTIONAL CONTROLLER (Fig. 2)*

This controller has a selector handle, throttle handle and reverse handle.

Selector Handle

The selector handle is a ratchet-type handle used to set up the desired mode of operation – power or dynamic braking.

The handle is spring-loaded to make it self-centering after it has been released by the operator. It must be actuated and released as many times as it takes to achieve the desired mode of operation. The mode of operation will register at the indicator window to the left of the selector handle.

NOTE: The Optional Controller installed on some locomotives built in early 1972 does not have the ratchet-type selector handle. Instead, a three-position selector handle is used, with the mode of operation indicated in the window above the handle by "B" (dynamic braking), OFF, or PWR (power), as the handle is moved from full-left to full-right.

Movement of the handle to the right (away from the operator) will set up motoring power. Movement to the left will set up dynamic braking.

* The Optional Controller has been used on some locomotives at the request of the railroad. It may be identified by the dark red housing for the three handles.

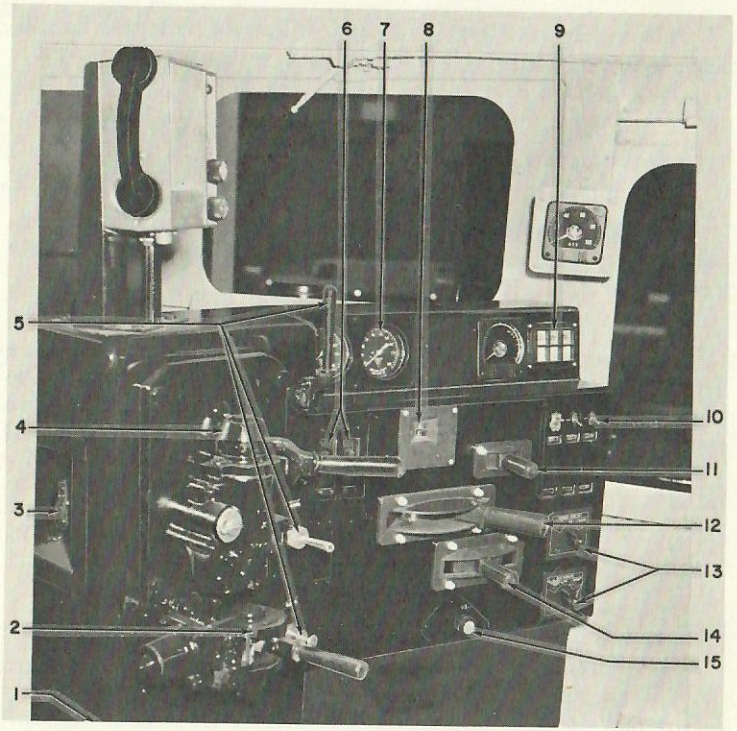


Fig. 2 (E-17767)

1 MU-2A valve (or two-position cock) (lower side)
2 Independent brake valve
3 Regulating valve
4 Automatic brake valve
5 Horn-bell and sander controls
6 Generator field and dynamic brake circuit breakers
7 Instrument panel
8 Controller indicator window
9 Indicating-light panel
10 Switch panel
11 Selector handle
12 Throttle handle
13 Front and rear headlight switches
14 Reverse handle
15 Call button

Fig. 2. Operator's position (with optional controller)

CAUTION: MAKE SURE THAT THE PROPER SELECTOR HANDLE SETTING HAS BEEN MADE BEFORE ADVANCING THE THROTTLE HANDLE; OTHERWISE, SEVERE EQUIPMENT DAMAGE AND POSSIBLE PERSONAL INJURY COULD OCCUR.

Throttle Handle

The throttle handle located below the selector handle has a STOP, IDLE, and eight major positions or notches for motoring power. In dynamic braking the throttle movement is notchless from IDLE to FULL ON position.

The STOP position is a short section of the throttle quadrant to the right of IDLE. This position is usually used in an emergency to shut down all engines in the MU consist from the operator's position of one unit.

To move the handle to the STOP position, pull the spring-loaded handle out (about 1/4 inch) to clear the projecting section and shove the handle to the right and against the stop to shut down all engines not already isolated.

NOTE: The throttle position, whether power or braking, will register in the same indicator window as the selector handle position.

Reverse Handle

The reverse handle, located below the throttle handle, has NEUTRAL, FORWARD and REVERSE positions. The handle is removable in the NEUTRAL position when the selector handle is in OFF and the throttle handle is in IDLE.

Operation

To manipulate the controller operating handles during locomotive operation, proceed as follows:

1. With the throttle handle in IDLE and selector handle in OFF position, move the reverse handle to the desired direction of operation.

2. Move the selector handle to the desired mode of operation, Power or Braking.

CAUTION: OBSERVE THE INDICATOR WINDOW TO CONFIRM THAT THE PROPER MODE OF OPERATION HAS BEEN SELECTED.

3. Advance the throttle handle as required.

Devices on the Control Stand
(See Figs. 1 and 2)

The following operating devices are located on the control stand:

Power Limit Switch

This switch has two positions, NORMAL and NOTCH 7. When locomotive units of the same horsepower are operated in the locomotive consist, this switch is ordinarily in the NORMAL position.

When the leading unit is slipping excessively, the power limit switch can be moved to NOTCH 7 to reduce power while the trailing units are operating at full power. This will reduce the tractive effort on the leading unit and will usually improve the ability of the locomotive to hold the rail under bad rail conditions.

When other locomotives of lower horsepower ratings are operated in the consist, under certain conditions, this switch must be moved to the NOTCH 7 position unless the locomotives are equipped with automatic power-matching control.

NOTE: Unless directed otherwise by railroad rules, make sure that the Power Limit Switch is in NORMAL position on all units when boarding the train.

Other Switches

a. Front headlight

b. Rear headlight

c. Step lights

d. Gage lights and dimmer control

Call Button

The call button is used to sound the alarm bell in all locomotive units.

Wheel-slip Light

This light indicates when the wheels slip.

"PCS OPEN" Light

This light indicates that the PCS switch is "open" and has not been reset.

Generator-field Circuit Breaker

The generator-field circuit breaker is ON whenever the locomotive is powered and operating as a lead unit. The breaker may also be used to keep the main generator de-energized when it is necessary to run the engine at speeds higher than idle.

Other Controls and Devices

Depending on customer requirements, other controls and devices such as Hump Control, Mars Headlight, Air Flow Indicator, etc., may also be located on the controller housing.

ENGINE CONTROL PANEL

The engine control (EC) panel is located on the rear wall of the operator's cab (see Fig. 3). Mounted on this panel are various other switches, circuit breakers and operating devices used during locomotive operation.

ENGINE CONTROL SWITCH (See Fig. 3)

The engine control switch has two positions, START and RUN. The engine start button is effective only when the EC switch is in the START position.

When the engine is running and the EC switch is in START position, engine speed is held at idle and power cannot be applied to the locomotive. The power plant is said to be "off the line".

When the engine is idling and the locomotive is to be operated, the engine control switch (EC) must be moved to the RUN position.

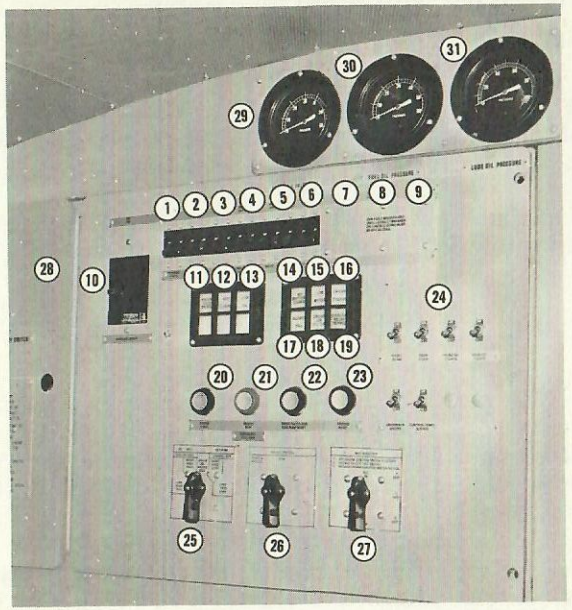


Fig. 3 (E-19097)

1 Running lights
2 Fuel pump
3 Local control
4 Engine run
5 Headlights
6 Radio
7 Control
8 (Optional equipment)
9 (Optional equipment)
10 Charging circuit
11 Ground relay tripped
12 Hot engine
13 Low oil
14 No battery charge
15 Low water
16 Crankcase overpressure
17 Blower fail
18 Engine air filter
19 Overload relay tripped
20 Engine start
21 Engine stop
22 Fuel-pump reset
23 Ground reset
24 Light switches
25 MU headlight set-up switch
26 Engine control switch
27 Motor cut-out switch (optional)
28 Battery switch compartment
29 Turbo (intake manifold) air pressure
30 Fuel-oil pressure
31 Lube-oil pressure

Fig. 3. Engine control panel

ENGINE START AND STOP BUTTONS
(See Fig. 3)

To start the diesel engine, depress the ENGINE START button firmly and hold until the engine starts. To stop the engine, depress the STOP button momentarily.

The engine start button is effective only when the engine control switch (EC) is in the START position.

MU HEADLIGHT SET-UP SWITCH

The MU headlight set-up switch has five positions. Positioning of this switch is determined by location of the locomotive unit in the consist and whether the front of the locomotive unit is leading or trailing. Switch positions are as follows:

SINGLE OR MIDDLE UNIT: Place switch in this position on any locomotive unit operated singly or on all units, except the leading or trailing unit, when the locomotive consist is made up of more than one unit.

SHORT HOOD LEAD – LEADING UNIT: Place switch in this position when the leading unit is operated with the short hood forward.

LONG HOOD LEAD – LEADING UNIT: Place switch in this position when the leading unit is operated with the long hood forward.

SHORT HOOD TRAIL – TRAILING UNIT: Place switch in this position when the final trailing unit is connected so its short hood trails.

LONG HOOD TRAIL – TRAILING UNIT: Place switch in this position when the final trailing locomotive is connected so its long hood trails.

MU BRAKING SELECTOR SWITCH

The MU dynamic braking selector switch (when installed) is furnished in several styles, depending on the request of a railroad. Position the selector switch according to the directions on the nameplate and according to railroad rules.

The selector switch must be positioned before leaving the terminal and must not be changed even if the engine is isolated enroute.

MOTOR CUT-OUT SWITCH

The motor cut-out switch (if installed) can be used to cut out one or more traction motors. At the same time, power output of the locomotive will be reduced. Operation of the motor cut-out switch does not eliminate a ground fault in a power circuit.

Under emergency conditions the locomotive may be operated for a short period of time with one or more motors cut out. Refer to railroad rules for specific details of operation.

CAUTION: THIS SWITCH SHOULD BE OPERATED ONLY WITH THE ENGINE CONTROL SWITCH IN START POSITION SO THE UNIT IS ISOLATED. OTHERWISE, THE TRACTION MOTORS MAY BE DAMAGED.

CIRCUIT BREAKERS ON EC PANEL
(See Fig. 3)

The following circuit breakers are located on the engine control panel:

1. Engine Run

2. Charging Circuit – Isolates battery-charging generator from the control system.

3. Running Lights (all lights except headlights)

4. Headlights

5. Control (NOTE: On some arrangements this breaker may be located on the control stand switch panel.)

6. Fuel Pump

SWITCHES ON EC PANEL
(See Fig. 3)

The following switches are located on the engine control panel:

1. Hood-Engine-Control Compartment Lights

2. Rear Classification Lights

3. Front Classification Lights

4. Front Number Lights

5. Rear Number Lights

6. MU Walkway Lights (if equipped)

GROUND RELAY (See Fig. 3)

The ground relay is furnished to protect the power and control circuits. An indicating light will come on and the bell will ring when the relay has tripped. The reset button must be pushed to reset the relay.

NOTE: On some railroads an automatic reset system is used.

MISCELLANEOUS CONTROLS

In addition to the previously described operating devices, the following additional controls are used by the engineman during locomotive operation:

1. Bell Valve – Mounted on the engineman's control stand. (See Fig. 1.)

2. Horn Valve – Mounted on the control stand. (See Fig. 1.)

3. Sander Control – Mounted on the control stand. (See Fig. 1.)

4. Windshield Wiper Valves – Located on the control stand and over fireman's positions.

5. Hand Brake – Located on outside of nose compartment (low-nose locomotive).

6. Emergency Brake Valve – Handle located on helper's side of control stand. Pulling this handle causes an EMERGENCY brake application and dropping of power.

7. Emergency Fuel Cut-off System – In an emergency any one of three electric push buttons may be depressed momentarily to cut off fuel delivery and shut down the engine. One of these buttons is located on each side of the locomotive platform near the fuel tank. The third button (Engine Stop) is located on the Engine Control Panel and is also used for normally shutting down the engine.

NOTE: The emergency cut-off button is used to shut down the engine on the local unit only. The SHUTDOWN position of the throttle handle on the Master Controller will shut down the engines on all units of the consist simultaneously.

8. Fuel-trip Reset Button – This button on the Engine Control Panel must be depressed before depressing the engine start button for engine starting and after any emergency fuel cut-off button has been depressed.

9. Cab Heater – Cab heat is regulated by turning the regulating valve behind the control stand to give the desired heat. Adjust the louver control at the base of the heater for suitable air deflection and flow. (Note: A second heater valve is located under the cab floor.)

CAUTION: TO PREVENT THE HEATER FROM FREEZING IN COLD WEATHER, LEAVE BOTH VALVES OPEN AT ALL TIMES.

10. Window Defrosters – The heat for window defrosting is controlled by the same regulating valve which controls cab heat.

11. Cab Ventilation – Cab ventilation is controlled by positioning the hand-operated lever at the base of the cab heater as desired.

AIR BRAKE EQUIPMENT

The schedule 26-L equipment, arranged for single-end, multiple-unit operation, is used on this locomotive. The principal parts are:

26-C BRAKE VALVE (See Fig. 4)

This brake valve consists of two separate valves: the Automatic brake valve and the Independent brake valve. The automatic valve is designed for regulating brake-pipe pressure to control both locomotive and train brakes. The independent valve will apply and release locomotive brakes independent of the train brakes. The independent valve also controls the release of the locomotive brakes (due to an automatic brake application while in force) without releasing the train brakes.

Fig. 4 (E-8924D)

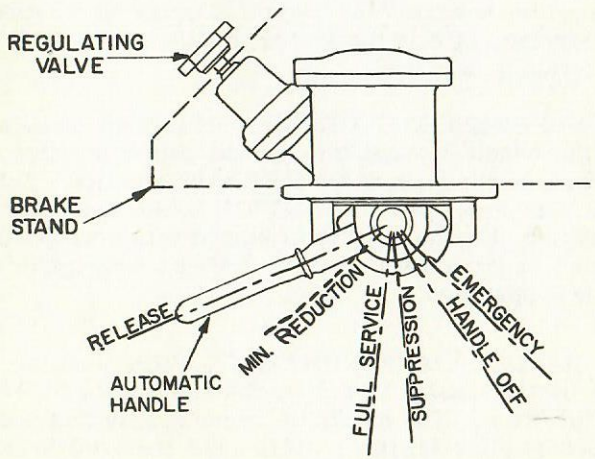


Fig. 4. Automatic brake valve handle positions

AUTOMATIC BRAKE VALVE HANDLE (See Fig. 4)

The automatic brake valve handle has six positions:

1. RELEASE (RUNNING) POSITION – This position charges the equipment and releases the locomotive and train brakes after an automatic application. This is accomplished by controlling air flow to the brake pipe as set by handle position of regulating valve (on back of brake stand). The RELEASE position is at the extreme left of quadrant and is the normal position when the automatic brake is not in use.

2. MINIMUM REDUCTION POSITION – This position is located to the right of the RELEASE position where the brake valve handle reaches the first raised portion of the quadrant. With the brake valve handle moved to this position, the minimum service application is obtained which results in a four to six pound brake pipe reduction.

3. SERVICE POSITIONS – This sector for brake valve handle movement is to the right of the MINIMUM REDUCTION position. Moving the handle from the left to right in this sector increases the degree of brake application. At the extreme right of the sector, a FULL SERVICE brake application is obtained.

4. SUPPRESSION POSITION – This position is located with the handle against the second raised position of the quadrant, to the right of the RELEASE position. This position provides a FULL SERVICE brake application and in addition, on locomotives equipped with overspeed control and safety control penalty brakes, these applications will be suppressed.

5. HANDLE - OFF POSITION – This position is located by the quadrant notch to the right of the SUPPRESSION position. The handle is removable in this position. It must be placed in this position and removed on trailing units of a multiple-unit consist or on locomotives being towed "dead-in-train."

6. EMERGENCY POSITION - This position is located to the extreme right of the brake valve quadrant. It is used for making a brake valve EMERGENCY brake application.

When an emergency application is received, the Automatic brake valve handle must be moved to the EMERGENCY position and left in this position until the equalizing reservoir gage hand indicates zero ("0") pressure. The Automatic brake valve handle must then be moved to the RELEASE position to recharge the brake pipe and release the brakes.

NOTE: If equipped with split reduction for penalty application, the penalty control functions.

When the penalty control functions, a service brake application is made about five seconds after a warning whistle sounds. Leave the Automatic brake valve handle in RELEASE position during the initial reduction of approximately nine pounds for approximately 20 seconds. At the start of the second reduction (indicated by a further drop in equalizing reservoir pressure), move the Automatic brake valve handle to the SUPPRESSION position and leave it in this position until the application gage hand shows not less than 125 pounds pressure, then move the Automatic brake valve handle to the RELEASE position.

INDEPENDENT BRAKE VALVE HANDLE
(See Figs. 1 and 2)

The Independent brake valve handle applies and releases the brakes on the locomotive consist or releases the brakes on the locomotive unit alone, after an automatic or emergency application.

The Independent brake valve has two positions, RELEASE and FULL APPLICATION, with the application zone between. The brake valve is of the self-lapping type

which automatically maintains brake cylinder pressure when the application pressure reaches a value corresponding to the handle position. An Independent brake application can be released only by movement of the handle toward the RELEASE position. An automatic Service or Emergency application can be released on the locomotive consist by depressing the Independent brake valve handle in the RELEASE position.

PILOT CUT-OUT COCK (BRAKE VALVE CUT-OUT) (See Fig. 5)

This cock, also known as the "double-heading cock", is located on the front of the Automatic brake valve. Push in the handle and turn to position for type of service. The OUT position is used when the locomotive is operated in Trail.

MU-2A VALVE (EQUIVALENT OF ROTAIR VALVE)

This is a two- or a three-position valve located on the brake stand. It enables a locomotive equipped with 26-L brakes to be operated in multiple with locomotives having similar or other types brake equipment. Push handle in and turn to change positions.

NOTE: On some railroads, this device is replaced by a two-position cut-out cock in same location.

For three-position MU-2A valve (RED) the positions are: LEAD or DEAD, TRAIL-6, and TRAIL-24 or -26.

1. LEAD or DEAD position is used when locomotive unit is operated singly or when it is the lead unit of a multiple-unit consist. Position is also used when locomotive unit is hauled "dead-in-train".

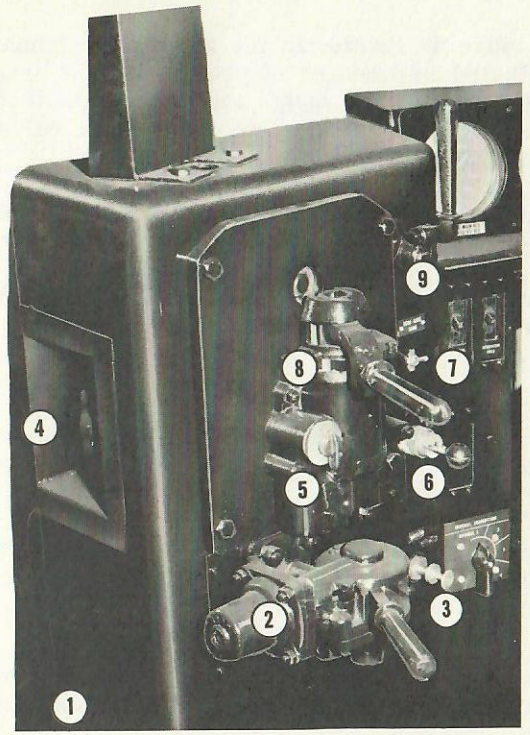


Fig. 5 (E-19098)

1 MU-2A valve (or two-position cock)
2 Independent brake valve
3 Bell valve
4 Regulating valve
5 Brake-valve cut-out cock
6 Sander valve
7 Lead-axle sand switch
8 Automatic brake valve
9 Horn valve

Fig. 5. Air and air brake controls

2. TRAIL-6 or -26 position is used to trail a lead locomotive having 6SL or 26L brake equipments.

3. TRAIL-24 position is used to trail a lead locomotive having 24RL brake equipment.

TYPE 26-F CONTROL VALVE

This valve is located in the air brake compartment. When actuated by changes of pressure in the brake pipe, it operates to charge, apply, and release the locomotive brakes. The Release Cap on the control valve can be mounted in two ways:

1. With letters GRA over word RELEASE. This position provides graduated release of automatic brakes.

2. With letters DIR over word RELEASE. This position provides direct release of automatic brakes.

DUPLEX AIR GAGES

The following air gages are located on the gage panel in front of the engineman:

1. Main Reservoir – Equalizing Reservoir – Red hand indicates main reservoir pressure; white hand indicates equalizing reservoir pressure.

2. Brake Cylinder – Brake Pipe – Red hand indicates locomotive brake cylinder pressure; white hand indicates brake pipe pressure.

3. Application-Suppression (if installed) – Red hand indicates overspeed or safety control "penalty" applications; white hand indicates suppression (if this feature is used).

CUT-OUT COCKS

At specified inspection or maintenance periods, the following manually operated devices are used:

1. Main Reservoir Cut-out Cock – Located on right side of locomotive near the rear main reservoir.

2. Main Reservoir Drain Cocks – One located on the end of each main reservoir, usually part of automatic drain valves.

3. Air-filter Drain Cocks – Normally located at rear of fuel tank on filter and on auxiliary air filter at front of fuel tank.

4. Control-air Cut-out Cock – Located in air brake compartment as part of reducing valve.

5. Control-air Reservoir Drain Cock – Located in air brake compartment on rear wall.

6. Brake Cylinder Cut-out Cocks – Located on right side beneath locomotive platform level (one for each truck).

7. Air Compressor Governor Cut-out Cock – Located beside lube oil cooler in engine cab on right side of locomotive.

8. Bell, Horn and Window Wiper Cut-out Cock – Located in air brake compartment.

9. Sander Control Cut-out Cocks – Located behind door above top side step on right side of locomotive, both ends.

10. Cut-out Cocks at Each End of Locomotive (see Fig. 6):

   a. Brake pipe angle cocks or cut-out cock behind end frame with snow plows

   b. Main Reservoir Equalizing

   c. Actuating

   d. Brake Cylinder Equalizing (Independent Application and Release)

   e. Forward Sand (if used) – Pneumatic MU Sanding (right side)

   f. Reverse Sand (if used) – Pneumatic MU Sanding (left side)

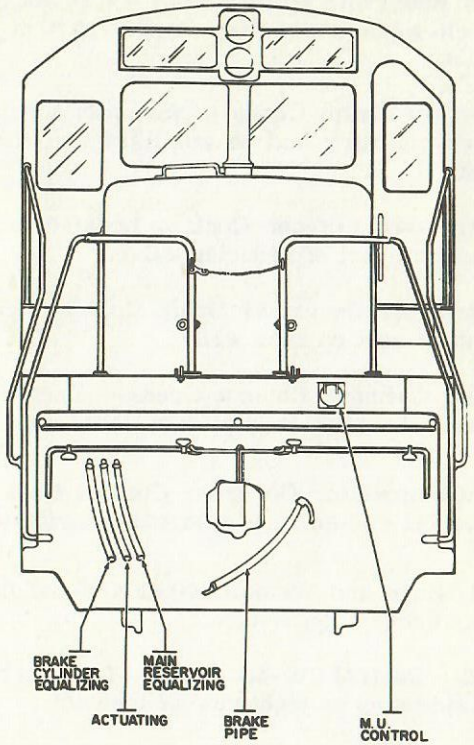


Fig. 6 (E-11821A)

Fig. 6. Locomotive end connections

11. Safety Control Cut-out Cock (if used) – Located in air brake compartment. Cuts out safety control feature when closed. (See Air Piping Diagram for inclusion and specific location.)

12. Overspeed Control Cut-out Cock (if used) – Located in air brake compartment. Cuts out overspeed control feature when closed.

13. Dead Engine Cock – Located in air brake compartment.

ADJUSTING VALVES

AIR REGULATING VALVE (FEED VALVE) (See Fig. 5)

The air regulating valve, located on the control stand, automatically maintains a predetermined air pressure in the brake system. A clockwise movement of the adjusting handle increases the pressure setting. A counterclockwise movement decreases the pressure setting. Adjust to conform with railroad regulations.

CONTROL AIR REDUCING VALVE

This valve maintains a predetermined normal air pressure in the air pressure supply for operation of the reverser, braking switch, and pneumatic contactors. Clockwise adjustment of the adjusting screw increases pressure. Normal control air pressure is 70 pounds.

CIRCUIT BREAKERS (See Fig. 3)

1. Operated like a toggle switch to open circuit manually.

2. Overload in a breaker circuit causes breaker to open the circuit automatically and the toggle moves into center position indicating breaker has tripped.

3. Breaker is reset by moving to OFF, then to ON, after allowing a few minutes for thermal element in the breaker to cool. The breaker should only be reclosed if there is no visible reason for the automatic opening of the circuit. If it trips after reclosing, it should be left open unless instructed otherwise.

COLORED LIGHTS AND BELL

During normal locomotive operation, the bell and all colored lights are off. When locomotive consists of more than one unit, colored lamps will light on affected unit only. Bell will sound on all units.

NOTE: If troubles occur on two or more units at the same time which cause the alarm bell to ring, turn the EC switch on all affected units to START position before attempting to restart any unit. With the throttle handle on the lead unit beyond IDLE position, it is impossible to start any unit while the alarm bell is ringing.

LOW-OIL AND LOW-WATER LIGHTS (YELLOW) (See Fig. 3)

A yellow light on the Engine Control Panel will light when either the engine lube oil supply or the cooling water pressure is low.

1. If engine lubricating-oil pressure drops to between 7 to 12 psi at idle speed, or between 47 to 52 psi at full speed, the engine shuts down and a yellow LOW OIL indicating lamp lights. After the engine shuts down, the alarm bell will sound as long as the engine control switch (EC) is in the RUN position.

A yellow LOW WATER indicating lamp will also come on if the water pressure or supply is low.

2. After the engine shuts down, move the EC switch to START to silence the alarm bell. Check the lubricating oil supply on the dipstick. Check for broken or cracked oil lines. Also check the water supply at the storage tank and check for water piping leaks.

3. To restart the diesel engine after a fault is corrected:

a. Depress the shutdown plunger on the engine governor until it clicks and stays in.

NOTE: The engine governor is equipped with two shutdown plungers, one for low oil and one for low water. Be sure both plungers are reset.

b. Depress the engine START button.

c. After the engine is running, recheck for signs of distress.

d. If the condition is normal, put the locomotive "on the line" and recheck for signs of distress.

4. If the engine fails to start due to the LOW OIL PRESSURE RESET button tripping, do not repeat cranking.

CAUTION: REPEATED CRANKING OF THE ENGINE, WITHOUT STARTING, WILL NOT

ONLY DISCHARGE THE BATTERY BUT CAN DAMAGE THE ENGINE IF THE FAULT IS LACK OF LUBE OIL PRESSURE. IF FIRST ATTEMPT FAILS TO RESTART THE ENGINE, CEASE CRANKING AND PROCEED AS DIRECTED BY RAILROAD RULES.

5. If locomotive units are being operated in multiple, then the engine on the affected unit only will shut down.

CRANKCASE OVER-PRESSURE SWITCH
(See Fig. 7)

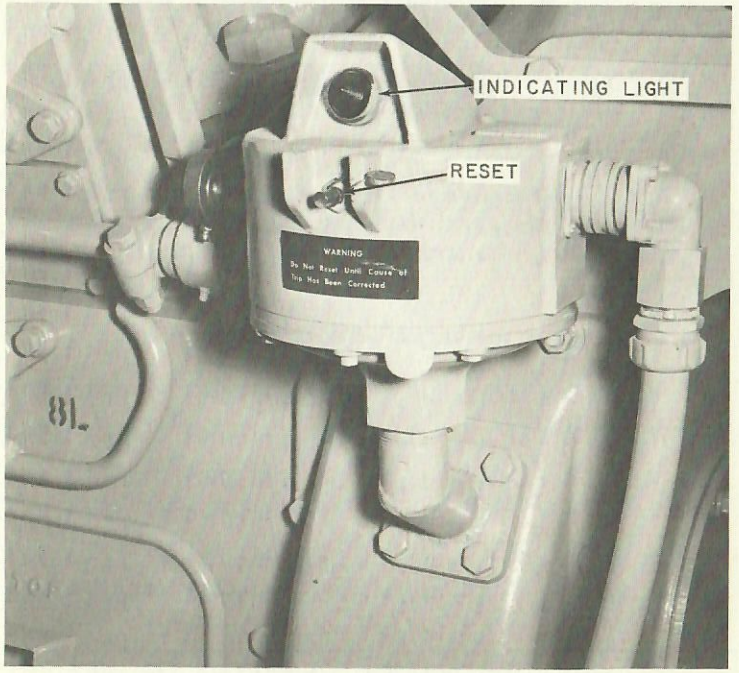


Fig. 7. Crankcase over-pressure switch

Fig. 7 (E-16527)

A crankcase over-pressure switch is mounted on the left side of the engine near the generator. The switch will shut down the engine in case a serious engine fault occurs.

When the switch trips, the engine shuts down automatically, the alarm bell rings, and an indicating light comes on in the operator's cab and on the housing of the switch.

When such a fault occurs, take the locomotive off the line and leave the engine shut down. Proceed as directed by railroad rules.

CAUTION: BEFORE THE ENGINE IS RESTARTED, CAUSE OF THE SHUTDOWN MUST BE DETERMINED AND THE FAULT CORRECTED.

HOT ENGINE LIGHT (RED)
(See Fig. 3)

1. If engine water temperature becomes excessive, the alarm bell sounds and the HOT ENGINE indicating lamp (red) lights.

NOTE: On some locomotive models, the engine speed will return to Idle for the duration of the HOT ENGINE alarm.

At first opportunity investigate for cause. When cooling water temperature returns to normal, the alarm bell will stop ringing. Turning the engine control switch (EC) to START will not stop the ringing of the alarm bell or turn off the HOT ENGINE light. If cooling water temperature does not return to normal in a reasonable length of time, shut down the engine.

NO BATTERY CHARGE (BLUE)
(See Fig. 3)

If the engine is running and the engine control switch (EC) is in RUN position and battery charging equipment fails, then the NO BATTERY CHARGE lamp (blue) will light and the alarm bell will sound. The light will also come on if the engine is not running, but the battery switch is closed. Under this condition, a fault does not necessarily exist.

ALTERNATOR OVERLOAD RELAY

A surge relay (GOLR) is provided to detect power faults which could cause alternator overloading and go to ground. The fault detection also prevents excessive equipment damage caused by an inoperative ground relay. An indicating light on the Engine Control Panel will light when such a fault has occurred.

BLOWER FAIL

In the event that the equipment blower operation should fail, a BLOWER FAIL light on the EC panel will come on. The engine speed returns to IDLE and power is removed.

CAUTION: NO EFFORT SHOULD BE MADE TO POWER THE LOCOMOTIVE UNTIL THE EQUIPMENT BLOWER IS FURNISHING VENTILATING AIR; OTHERWISE, SERIOUS EQUIPMENT DAMAGE COULD RESULT.

After the fault is corrected, normal locomotive operation is restored automatically.

GROUND RELAY
(See Fig. 3)

1. Ground relay operation:

   a. If a ground occurs in the main power circuits, the ground relay operates to reduce engine speed automatically to IDLE, removes power from traction motors, and sounds the alarm bell.

      An indicating light (Ground Relay Tripped) on the Engine Control Panel will light, indicating that a fault has occurred.

   b. If a ground occurs in the control circuits, the ground relay may operate during the engine cranking cycle. Report this condition.

2. To reset the ground relay:

   a. Take the engine "off the line".

   b. Push in the ground relay reset button on the engine control panel.

   c. Advance the throttle handle. If the ground relay stays in, continue normal operation.

NOTE: On locomotives equipped with a trainline Ground Relay Reset, a tripped relay is indicated by a warning light. Wait 15 seconds before attempting to reset the relay. Make a visual observation of the locomotive consist, and if no unusual conditions are observed then press the RESET button. Limit reset attempts to two, or as directed by railroad rules. The same RESET button is pressed and the same resetting procedure applies when an overload relay (GOLR) has tripped.

3. If the ground relay immediately operates a second time, the affected unit must not be operated. The unit must either be shut down or, if necessary, the engine can be left running by turning the EC switch to START. This takes the unit "off the line".

NOTE: When the ground relay cut-out switch (GRCO) is opened, the unit must not be operated.

PCS SWITCH

The pneumatic control switch (PCS) is operated from the air brake system.

During a safety control "penalty" or emergency air brake application, this switch opens. Engine speed is reduced to IDLE and power is removed. The "PCS OPEN" ("PC OPEN") light at the engineman's position will light.

To reset the PCS switch automatically:

1. Move the throttle handle to IDLE.

NOTE: If the PCS switch has tripped while in dynamic braking, the selector handle must be returned to OFF to reset the circuit.

2. Move the automatic brake valve handle to SUPPRESSION.

3. Depress the safety control foot pedal (if used). (When the application pipe builds up to normal pressure, PCS will reclose.)

4. Move the automatic brake valve handle to RELEASE.

WHEEL SLIP

If any wheels slip during locomotive operation, normally the following occurs:

1. A reduction in excitation and immediate sanding occurs automatically on the locomotive that is slipping.

2. If wheels continue to slip for more than two or three seconds, the wheel slip lamp (on the control stand) lights.

3. Excitation continues in reduced state.

4. When wheel slip is corrected (wheel speed under control), excitation will return to normal and sanding tapers off.

NOTE: If wheel slips are observed, but the wheel slip light does not come on, a report should be made. The wheel slip detection equipment may require maintenance.

ENGINE OVERSPEED SHUTDOWN
(See Fig. 8)

In the event that the engine overspeeds to 1160 rpm, the engine is shut down automatically. After an overspeed shutdown of the engine, move the EC switch to START. Reset the overspeed mechanism by pushing in the knob of the engine overspeed governor (Fig. 8) located on the left side of the engine under the engine control governor. Proceed to start the engine as described under STARTING ENGINE. If it overspeeds again, do not restart the engine.

NOTE: If troubles occur on two or more units at the same time which causes the alarm bell to ring, turn the EC switch on all affected units to START position before attempting to restart any unit. With the throttle handle on the lead unit beyond IDLE position, it is impossible to start any unit while the alarm bell is ringing. (During freezing

weather, protect the engine cooling system according to railroad instructions.)

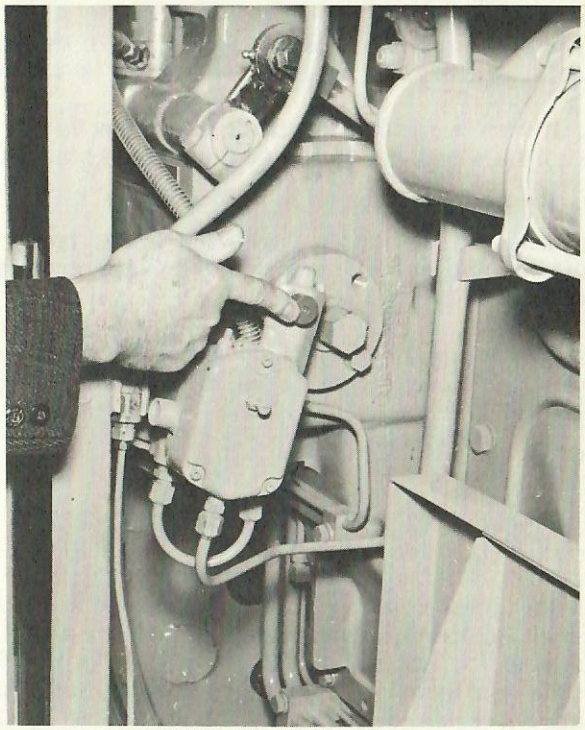


Fig. 8 (E-16528)

Fig. 8. Engine overspeed governor and reset

SAFETY CONTROL FOOT PEDAL

A foot pedal, if installed, is located at the operator's position. The pedal must be depressed at all times during locomotive operation. If the operator's foot is removed from the pedal for more than five seconds, the brakes will apply at the SERVICE rate. For further description, see SAFETY CONTROL.

EMERGENCY SANDING

Emergency sanding (if installed) is automatically applied in forward and reverse directions during all emergency brake applications, for a sufficient time to stop the train. In multiple-unit operation, emergency sanding is applied to all units, regardless of whether they are equipped with pneumatic or electro-pneumatic sanding equipment.

LOCOMOTIVE OVERSPEED

When a locomotive equipped with overspeed protection exceeds the maximum permissible speed, an overspeed application is initiated.

1. The overspeed whistle blows.

2. In about five seconds, a penalty brake application is initiated if train speed has not been reduced sufficiently. See air brake regulation for proper procedure.

ENGINE AIR FILTER LIGHT
(See Figs. 3 and 9)

An Engine Air Filter light on the EC panel will come on when the engine paper filters become plugged or dirty. When such a fault occurs, traction power will be removed and the engine speed will return to IDLE. Press the fuel pump reset button to reset the paper filter relay.

NOTE: Early stage of air filter cleanliness can be observed on the indicator mounted on the right side of the locomotive near the radiator. (See Fig. 9.) When the engine is running at full speed and the red band inside the indicator becomes

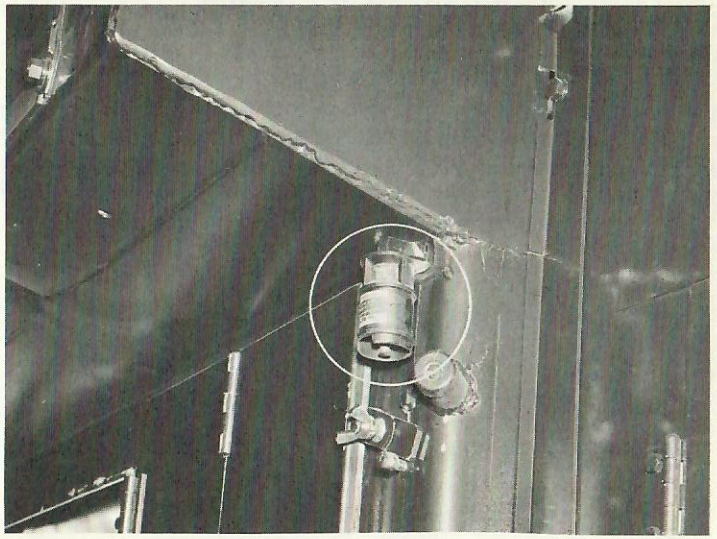


Fig. 9 (E-16529)

Fig. 9. Dirty air filter indicator

visible, the air filter is starting to get dirty. When the red band locks in place at the top, it is an indication that the air filter cleanliness has reached a condemning limit. Proceed as directed by railroad rules.

NO OIL PRESSURE LOCKOUT

A No Oil Pressure Lockout feature, when equipped, will prevent repeated engine cranking when no oil pressure is present. If adequate oil pressure does not build up in a predetermined time period cranking will be locked out, the warning bell will sound and the No Oil Pressure light on the EC panel will come on. After the cause of warning has been corrected a latching relay in the control compartment must be manually reset before engine cranking may be resumed.

CAUTION: MOMENTARY PUSH AND RELEASE OF THE ENGINE START BUTTON WILL RESULT IN A NO OIL PRESSURE LOCKOUT.

PRESSURE AND TEMPERATURE GAGES

1. Control Air – Usually located in the air brake compartment. Normal air pressure is 70 psi.

NOTE: The following values are nominal due to the effect of varying conditions.

2. Intake Manifold Air-pressure Gage – Located above the engine control panel in the operator's cab. (See Fig. 3.) Normal reading at FULL ENGINE SPEED and FULL LOAD is:

U23:	20 to 28 psi
U18-U30-U33-U36:	26 to 32 psi

3. Fuel Pressure Gage – Located above the engine control panel in the operator's cab. (See Fig. 3.) On current locomotive models normal fuel pressure at IDLE is 40 psi and at FULL LOAD is 33 psi.

NOTE: On some locomotive models fuel pressure values are 23 psi at IDLE and 19 psi at FULL LOAD.

4. Lube-oil Pressure Gage – Located above the engine control panel in the operator's cab. (See Fig. 3.) Normal lube pressure at IDLE is 10-25 psi and at FULL LOAD is 75-100 psi.

5. Water Temperature Gage - Located on the right side of the water storage tank. (See Fig. 10.) Normal operating temperature is 170-180 F.

OTHER GAGES

1. Engine Lubricating-oil Dipstick – One located on the side of the engine near the lube-oil fill. The stick is marked FULL and LOW. Proper level with the engine idling is between FULL and LOW.

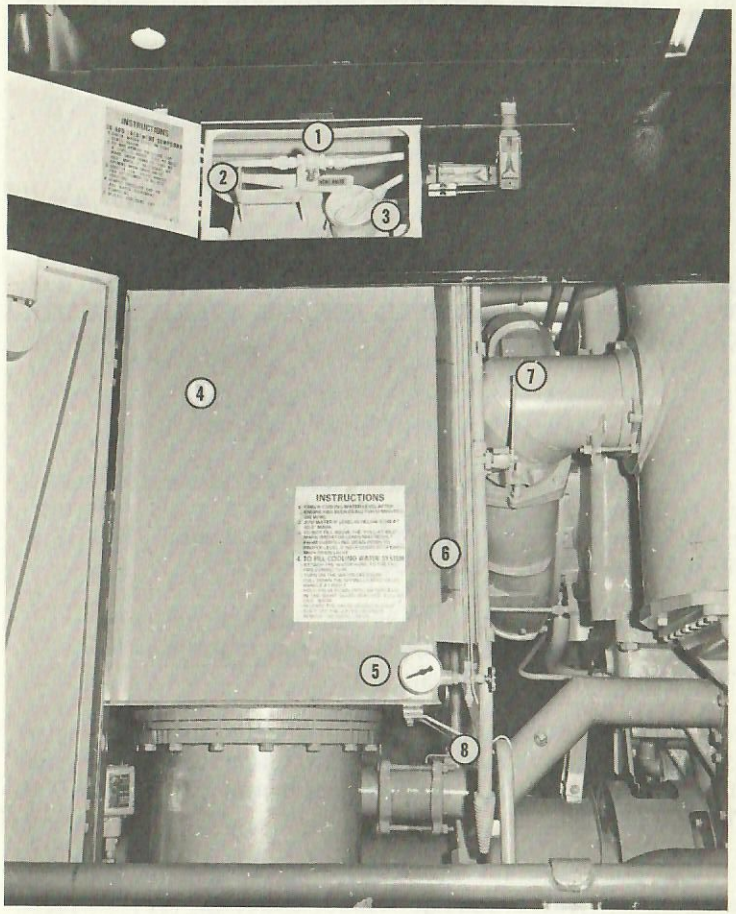


Fig. 10 (E-17770)

1 Vent valve
2 Vent-valve handle
3 Pressure cap
4 Water storage tank
5 Water temperature gage
6 Water-level sight glass
7 Fill-valve handle
8 Water fill pipe

Fig. 10. Water storage tank details

2. Fuel-oil Sight Glasses – Mounted on both sides of the main fuel tank to indicate the level of fuel in the tanks.

3. Cooling Water – A water level sight glass mounted on the side of the cooling water storage tank indicates the level of the cooling water. Markings near the sight glass indicate the proper level for different conditions of the system.

When filling the system, or adding water treatment compound, proceed according to instructions mounted on the water storage tank and on the inside of the fill cap door panel above. (See Fig. 10.)

WARNING: TO AVOID PERSONAL HARM FROM WATER BURNS, NEVER REMOVE THE WATER FILL CAP WHEN THE WATER LEVEL IS ABOVE "FULL AT IDLE" MARK.

4. Compressor Lube Oil (Gardner-Denver Compressor) – A gage mounted on the compressor frame indicates the oil level. The gage scale is marked ADD (lower red scale), RUN (green scale), EXCESSIVE (upper red scale). (Westinghouse Compressor – Maintain to RUN level on oil level indicator gage.) (See Fig. 11.)

5. Traction Alternator Gear Box – A dipstick marked EMPTY – ADD – FULL indicates oil level. Proper level is between ADD and FULL with the engine stopped. (See Fig. 12.)

6. Fan-gear-unit Oil Level – Maintain oil level near the spill-over of the fill pipe. (See Fig. 13.)

7. Governor Oil-level Sight Glass – Located on the left side of the engine near the traction generator. (See Fig. 14.) Oil level must be visible between marks on the sight glass when the engine is running.

CAUTION: TO PREVENT SERIOUS EQUIPMENT DAMAGE NEVER START AN ENGINE UNTIL THE ENGINE GOVERNOR HAS BEEN PROPERLY SERVICED WITH LUBE OIL.

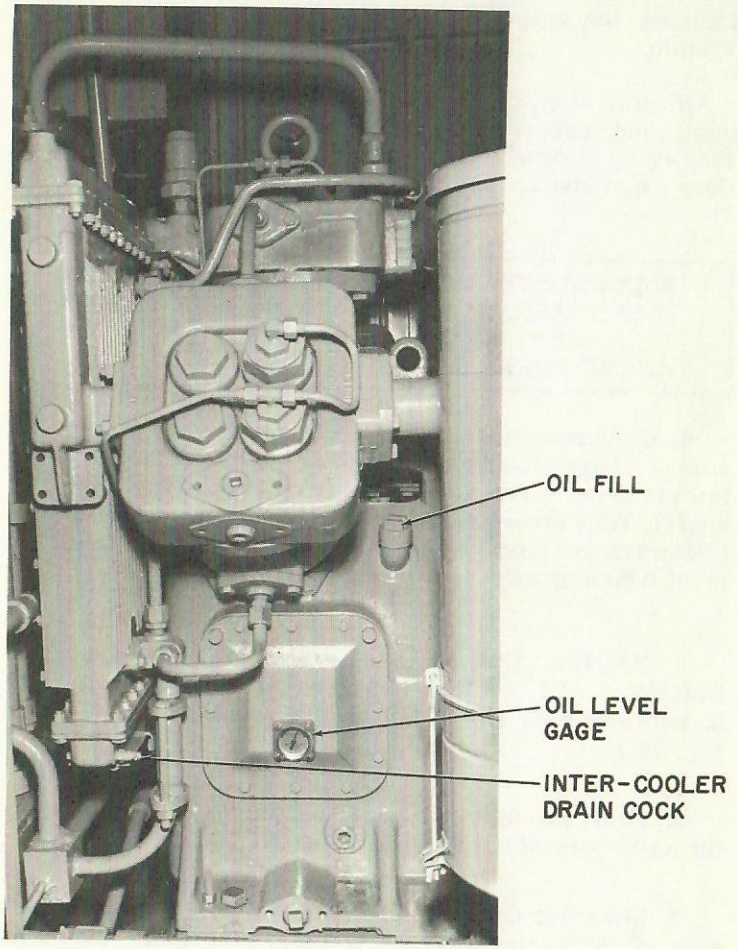


Fig. 11 (E-11826)

Fig. 11. Air compressor (WABCO)

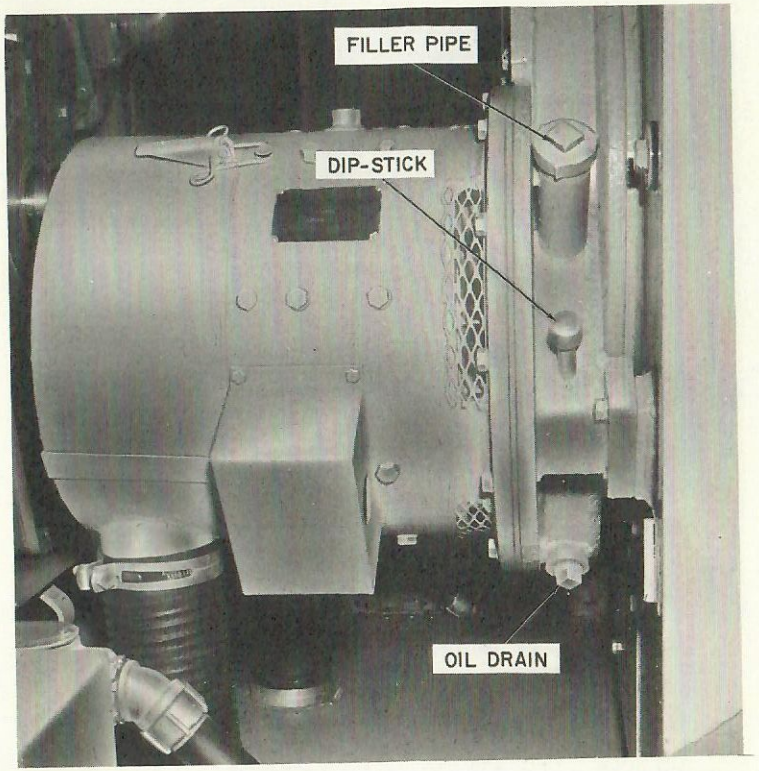


Fig. 12 (E-13029)

Fig. 12. Traction generator gear unit

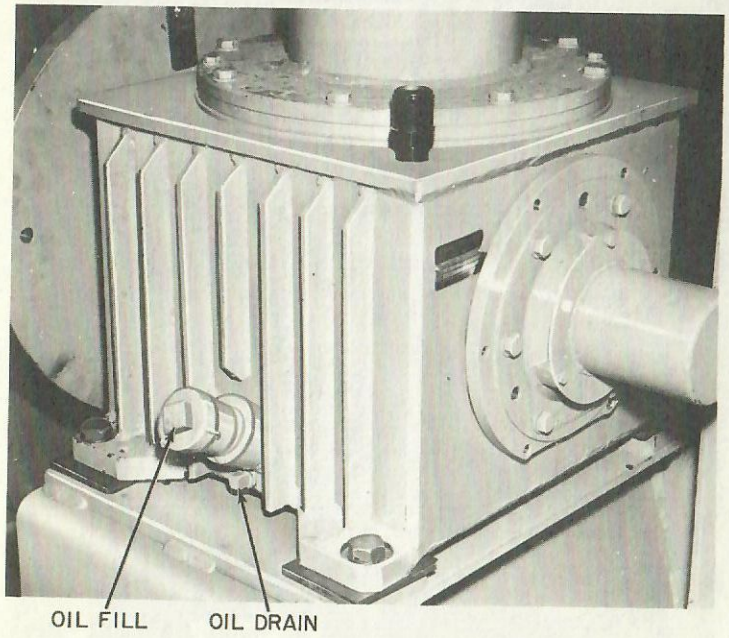


Fig. 13 (E-13530)

Fig. 13. Fan gear unit

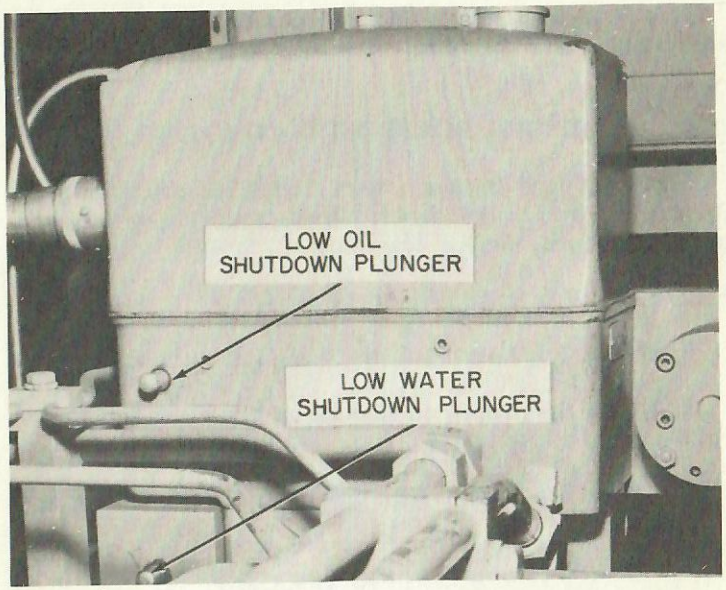


Fig. 14 (E-13296)

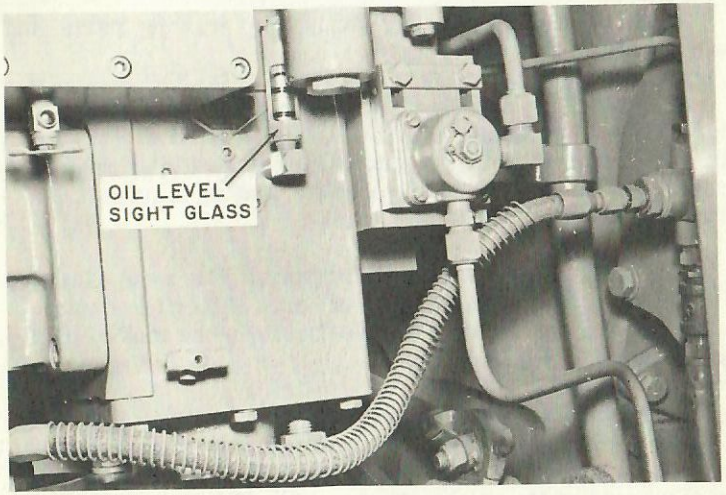


Fig. 14 (E-16536)

Fig. 14. Engine governor lubrication and low-oil and low-water resets

The following checks and inspections should be made in accordance with railroad rules.

BEFORE BOARDING LOCOMOTIVE

1. Inspect for broken, worn, loose, or dragging parts (brake rigging, brake shoes, wheels, traction motor commutator covers, etc.).

2. Check for leaks from outside piping.

3. Properly position all drain and cut-out cocks.

4. Check the proper connection of air hoses and jumper cables (if in multiple with other units).

5. Check the fuel supply on the fuel tank sight glass.

AFTER BOARDING LOCOMOTIVE

1. Remove rags, tools, etc., from moving parts and electrical equipment.

2. Check the diesel engine lubricating-oil supply. Oil level should indicate FULL on the measuring gage with the engine shut down. A measuring gage (dipstick) is located on each side of the engine and is marked LOW – FULL.

3. Check the governor oil supply. The sight glass on the governor should be full of oil. After the engine is started, the oil must be visible between the marks on the sight glass. (See Fig. 14.)

4. Check the air compressor lubricating-oil supply. On the Gardner-Denver compressor, the proper level is indicated when the pointer registers on the green portion of the scale of the oil-level indicator. The lower red scale indicates that oil must be added. The upper red scale indicates excessive oil. (See Fig. 11.) On the WABCO air

compressor, maintain the oil supply to the RUN level on the dipstick.

5. Check the cooling water supply. Be sure that the water drain valves are closed.

6. Check that the fan-gear unit oil level is up to the spill-over of the fill pipe.

7. Check the lubricating oil of the generator gear unit. The dipstick is marked EMPTY – ADD – FULL. The proper level is between the ADD and FULL marks. (See Fig. 12.)

8. Check that the diesel-engine overspeed device is reset. (See Fig. 8.)

9. Check that the engine barring-over device is removed from the engine.

10. Check that the following air cut-out cocks are open:

    a. Air compressor governor

    b. Control air

    c. Safety control (if used)

    d. Bell, horn and window wiper

    e. Overspeed control (if used).

11. Check that the brake-pipe angle cock is "cut-in" (vertical position).

12. The brake valve pilot cut-out cock (double-heading cock) on the 26L air brake system should be properly positioned.

13. The MU-2A valve or double cut-out cock must be positioned according to the location of the unit in the loco-

motive consist and the type of brake equipment in the lead locomotive.

14. Check the positions of the Automatic and Independent brake valve handles. The Automatic brake valve handle should be removed on all trail units, and the Independent handle should be in RELEASE if not removable.

15. Move the engine control switch to START.

16. Properly position the MU headlight selector switch.

17. Properly position the MU dynamic braking selector switch (if furnished).

18. Check that the Throttle handle is in IDLE and the Selector handle is in OFF.

19. Check that the dead-engine cock is closed.

STARTING ENGINE

1. Perform operations as in BEFORE BOARDING LOCOMOTIVE and AFTER BOARDING.

NOTE: If the engine has been stopped for a considerable period of time, the cylinders should be cleared of fuel or water accumulation before starting the engine.

Proceed as follows:

a. Apply the engine barring-over device and back off the compression relief plugs on the left side of each cylinder.

b. Rotate the engine at least two complete revolutions by use of the engine barring-over device.

c. Remove the barring-over device from the engine and tighten all compression relief plugs before cranking.

2. Check that the emergency stop feature is nullified (throttle in IDLE).

3. Close the battery switch located beside the EC panel in the operator's cab.

4. Check that the ground relay indicating light is not on. The cause of the ground fault must be removed before proceeding.

5. Close the following circuit breakers on the engine control panel:

a. Control Circuit

NOTE: When starting engines of several locomotives in a multiple-unit consist, start engines one at a time. Close the control circuit breaker only on one unit. Push the fuel pump reset button and allow the fuel pump to run a few seconds until some fuel pressure shows on the EC panel gage, before starting the engine. When all engines are running, close the control circuit breaker on the lead unit only.

b. Charging Circuit

c. Fuel Pump

d. Headlights

e. Running Lights

6. Push the engine start button on the engine control panel and hold until the engine starts.

NOTE: If proper engine lube-oil pressure does not build up within approximately 40 seconds, the governor will shut off fuel and prevent the engine from starting. (Refer to PRESSURE AND TEMPERATURE GAGES.)

CAUTION: DO NOT DISCHARGE THE BATTERY EXCESSIVELY BY REPEATED ATTEMPTS TO START. IF THE FIRST TWO OR THREE TRIES ARE UNSUCCESSFUL, RECHECK THE STARTING PROCEDURE.

BEFORE MOVING LOCOMOTIVE

1. Turn the engine control switch to RUN.

2. Make an air brake test and other checks in accordance with railroad regulations.

3. Check the main reservoir air pressure according to railroad rules.

4. Check the control air pressure. Normal pressure is 70 psi.

5. Make an independent air brake application. Release the hand brake and remove any blocking of the wheels.

6. Allow time for the engine cooling water to warm up before moving the locomotive in accordance with railroad rules.

FASTER AIR PUMPING

To provide faster air pumping on locomotive, when reservoirs have been drained or after the locomotive has been coupled to a train, proceed as follows:

1. Leave the generator-field circuit breaker in the OFF position.

2. Close the control breaker on the engine control panel.

3. Insert the reverse handle.

4. Move the throttle handle to the 4th or 5th notch as needed.

NOTE: If the main reservoir air pressure is above 130 psi and is not rising, increasing the engine speed will not raise the pressure.

MOVING A TRAIN

1. Close the generator field circuit breaker on the control stand.

> *CAUTION: TO PREVENT EQUIPMENT DAMAGE WHEN CHANGING FROM POWER TO DYNAMIC BRAKING OR FROM DYNAMIC BRAKING TO POWER, PAUSE 10 SECONDS WITH THROTTLE AT IDLE AND DYNAMIC BRAKING OFF.*

2a. (KC-108 Controller) Move the reverse handle to the desired direction of movement.

2b. (Optional Controller) Move the reverse handle to the desired direction of movement and the selector handle to the motoring position.

3. Place foot on the safety control foot pedal (if used) and release the brakes completely. Several minutes may be required to release the brakes, depending on the length of the train.

4. Advance the throttle handle.

NOTE: Some locomotives provide an advanced engine speed schedule. Throttle advance will cause a noticeable engine speed increase in notches 1 and 4 (full engine speed). However, power will increase in gradual increments from notch 1 through notch 8.

5. The throttle handle has notches (IDLE up to NOTCH 8), with each successive notch representing an increase in power, or locomotive tractive effort.

Starting a train depends on type, length, weight, grade, condition of rail, and amount of slack in the train. This locomotive is designed to have easily controlled tractive effort build-up characteristics, with the tractive effort in each notch limited to definite values as the throttle is moved from the lowest to the highest notch. No harm will be done by moving the throttle beyond Notch 4 when starting a train. The engineman can easily control the amount of tractive effort required to start and accelerate a particular train. Speed can be controlled as desired by reducing or increasing the throttle position.

STOPPING A TRAIN

Move the throttle handle to IDLE and apply the air brakes according to railroad regulations. If leaving the operator's position after the train has stopped, move the reverse handle to OFF.

REVERSING LOCOMOTIVE

1. Bring the locomotive to a full stop.
2. Move the reverse handle to the opposite direction.
3. Release the brakes.
4. Advance the throttle.

PASSING THROUGH WATER

Do not exceed two or three mph if there is water over the rails. Do not pass through water that is over 2.5 inches above the top of the rail.

PASSING OVER RAILROAD CROSSINGS

Do not pass over railroad crossings at full power or traction motor flashover may result. Reduce power by moving the throttle handle to the 5th notch, or below, while all units are passing over the crossing.

STOPPING ENGINES

1. Move the throttle handle to IDLE.
2. Open the GENERATOR FIELD circuit breaker on the control stand.
3. Move the engine control switch to START.
4. Press the STOP button on the engine control panel.
5. To shut down all engines when in multiple-unit operation, move the throttle handle to the SHUTDOWN position

on the master controller. The throttle handle must be in IDLE before attempting to start the engine.

BEFORE LEAVING LOCOMOTIVE

1. Apply the hand brake and release the air brakes after uncoupling from the train.

NOTE: On three-axle floating bolster trucks with low-hung brake cylinders, a "QR", or quick release valve is provided which removes the air in the one brake cylinder that is in the hand-brake system. The hand-brake chain must trip the stem of the QR valve and no trapped air is permitted in this brake cylinder; otherwise, if the locomotive air pressure leaks off, the locomotive can roll down the track unattended.

2. Leave the throttle in IDLE and the selector in OFF. Remove the selector handle after moving to OFF.

3. Open all switches and circuit breakers.

4. Close the windows and doors.

5. Open the battery switch.

6. In freezing weather, precautions must be taken to see that the cooling water does not freeze. See DRAINING COOLING SYSTEM and follow railroad rules for this situation.

SAFETY CONTROL

The safety control (if installed) consists of a foot-pedal operated air valve, whistle, and a cut-out cock. Except when the locomotive is stopped and locomotive brakes are applied, the engineman must keep the safety control foot pedal depressed at all times. This prevents safety control brake application.

After a penalty brake application has occurred, normal locomotive operation is restored in the following manner:

1. Move the throttle handle to IDLE.

2. Move the automatic brake valve handle to SUPPRESSION.

3. Depress the safety control foot pedal. (See Fig. 1.)

4. After the application pipe has built up to normal pressure, move the automatic brake valve handle to RELEASE.

NOTE: Other forms of Safety Control may be provided. See railroad rules for specific procedures.

Dynamic braking is applied to the locomotive only. A dynamic brake interlock keeps the air brakes on the locomotive from being applied when automatic air braking and dynamic braking are being used. The MU braking selector switch (when installed) must be positioned according to railroad rules.

APPLYING DYNAMIC BRAKING

Applying dynamic braking is done in the following manner:

1. Move the throttle handle to IDLE.

CAUTION: TO PREVENT EQUIPMENT DAMAGE WHEN CHANGING FROM POWER TO DYNAMIC BRAKING OR FROM DYNAMIC BRAKING TO POWER, PAUSE 10 SECONDS WITH THROTTLE AT IDLE AND DYNAMIC BRAKING OFF.

2a. (KC-108 Controller) Move the dynamic brake handle to SET-UP position. Then move the handle into the BRAKING sector as required.

2b. (Optional Controller) Move the selector handle from MOTORING to BRAKING. Advance the throttle handle slowly to bunch train slack. (Braking is now controlled by the throttle handle.)

3. After the slack is bunched, advance the throttle handle until the desired braking effort is obtained. Observe and correct braking effort during the initial period of dynamic brake application.

CAUTION: PROLONGED OPERATION OF DYNAMIC BRAKING IN 8TH NOTCH AT SPEEDS ABOVE 61 MILES PER HOUR CAN CAUSE INCREASED MAINTENANCE OF TRACTION MOTORS.

The amount of braking effort obtainable varies with the position of the throttle (or dynamic braking handle) for various speeds. Maximum braking effort is obtained in the 8th Notch at speeds of 22 to 30 mph depending on locomotive gearing.

When a locomotive is equipped with variable range dynamic braking, a series of peak braking efforts will occur down to about 8 mph.

NOTE: Wheel-slip warning may occur while in dynamic braking. This indicates that wheels are sliding. Sand is applied automatically to the wheels of the sliding unit. Reduce the throttle position until the warning stops.

USE OF AIR BRAKES DURING DYNAMIC BRAKING

When necessary, the automatic air brake may be used in conjunction with the dynamic brake. Automatic air brakes will apply on the train but not on the locomotive. If the automatic air brake handle is moved to the emergency position, the dynamic brake is removed and brakes on the locomotive as well as those on the train go into emergency application.

The independent air brake *must not* be used during dynamic braking to avoid flat spots on the locomotive wheels caused by sliding.

RELEASE OF DYNAMIC BRAKING

Release dynamic braking in the following manner:

KC-108 Controller – Move the dynamic braking handle to the OFF position.

Optional Controller – Move the throttle handle to IDLE.

OPERATING AS A LEADING UNIT

To operate the locomotive as a lead unit of a consist, proceed as follows:

1. Make the necessary preliminary preparations for operation.

2. Test the air brake in accordance with railroad rules.

3. Close the generator field circuit breaker.

4. Close the control circuit breaker (on lead unit only).

5. Move the selector handle to the desired direction.

6. When equipped with MU Braking Selector Switch (optional equipment), position the selector switch according to railroad rules.

7. Operate the locomotive in accordance with operating procedure.

OPERATING AS A TRAILING UNIT

AIR EQUIPMENT SET-UP

1. Make a Full Service application with the Automatic brake-valve handle.

2. Move the brake-valve pilot cut-out (double-heading) cock to the OUT position.

3. Move the Automatic brake-valve handle to the HANDLE OFF position and remove the handle.

4. Place the Independent handle in RELEASE position.

5. Move the MU-2A valve to suit brake equipment on the leading unit (either TRAIL-24 or TRAIL-26 or 6 positions).

ELECTRICAL SET-UP

1. Move the Selector handle to OFF and remove the handle.

2. Open the generator field circuit breaker on the control stand. Leave all breakers in the closed position on the engine control panel (EC) *except the control circuit breaker* and engine run switch, if used. The running lights circuit breaker may be positioned as desired.

3. Place the MU headlight set-up switch in the proper position.

4. Place the MU braking selector switch (if installed) in the proper position.

CHANGING OPERATING ENDS

To change operating control from the cab of one locomotive unit to the cab of another, proceed as follows:

VACATING UNIT–AIR EQUIPMENT SET-UP

1. Make a Full Service brake-pipe reduction.

2. Allow time for all air blowing sounds to stop; then depress the handle of the brake valve pilot cut-out cock and move it to the OUT position.

3. Place the Automatic brake-valve handle in the HANDLE OFF position and remove; place the Independent brake-valve handle in the RELEASE position.

4. Depress the handle on the MU-2A valve and move it to TRAIL-24, or TRAIL-6 or TRAIL-26 position, depending on the type of equipment used on the lead locomotive unit.

VACATING UNIT–ELECTRICAL SET-UP

1. Move the Selector handle to OFF and remove the handle.

2. Open the generator field circuit breaker on the control stand.

3. Leave all breakers in the closed position on the engine control panel (EC) *except the control circuit breaker* and engine run switch, if used. The running lights circuit breaker may be positioned as desired.

4. Move the MU headlight set-up switch to the required position.

OPERATING UNIT–AIR EQUIPMENT SET-UP

1. Insert the Automatic brake-valve handle in the HANDLE OFF position.

2. Move the Independent brake-valve handle to the FULL APPLICATION position.

3. Depress the handle of the MU-2A valve and move it to the LEAD or DEAD position.

4. Depress the handle of the brake-valve pilot cut-out cock and move it to the IN or FRT. or PASS. position as designated by the service in which the locomotive is to be operated.

OPERATING UNIT–ELECTRICAL SET-UP

1. Insert the Selector handle into the control stand.

2. Close the generator field circuit breaker on the control stand.

3. Close all circuit breakers on the engine control panel (EC). (The control circuit breaker must be closed on the lead unit only.)

4. Move the MU headlight set-up switch to the required position.

TO OPERATE
WITH OTHER TYPES OF UNITS

If the units of the locomotive consist are geared for differing maximum speeds, do not run at speeds in excess of that recommended for the unit having the lowest maximum permissible speed.

Similarly, do not operate at low speeds long enough to exceed the specified traction motor ratings on any of the units in the locomotive consist. A locomotive with high horsepower per axle will develop more tractive effort at any given speed than will units of lower horsepower per axle.

On GE units equipped with automatic power-matching control, power is automatically reduced to a lower level under certain conditions when operating at low locomotive speeds. Special operating instructions will be required for this feature.

When the leading unit is slipping excessively, the power-limit switch can be moved to Notch 7 to reduce the power on this unit while the trailing units are operating at full power. This will reduce the tractive effort on the leading unit and will usually improve the ability of the locomotive to hold the rail under bad rail conditions.

Units equipped with braking current-limiting regulators can be operated in multiple with GE locomotives in dynamic braking, regardless of the gear ratio or differences in maximum braking current ratings. If some units do not have current-limiting regulators, the locomotive consist

MUST always be operated so as not to exceed the braking current of the unit having the lowest maximum braking current rating. Special operating instructions will be required for this case.

When a locomotive unit with 26-L equipment is operated in multiple (lead or trailing) with 24-RL equipped units, or with units equipped with brakes of the No. 6 type, the following hose connections must be made:

26-L		24-RL		OR WITH NO. 6
Brake Pipe		Brake Pipe	to	Brake Pipe
M. R. Equalizing Pipe	to	M. R. Equalizing Pipe	to	M. R. Equalizing Pipe
Actuating Pipe	to	Actuating Pipe		
B. C. Equalizing Pipe	to	Ind. Appl. & Rel. Pipe	to	B. C. Equalizing Pipe
Sanding Pipe	to	Sanding Pipe	to	Sanding Pipe

26-L and 24-RL equipped locomotive units can be operated together in any combination.

26-L and No. 6 equipped locomotive units can be operated together in any combination.

With 26-L equipped locomotive leading one or more 24-RL equipped locomotive units, No. 6 equipped units with or without actuating pipe can trail.

Only if it has an actuating pipe can a unit having No. 6 type equipment be operated between a leading 26-L equipped unit and a trailing 24-RL or 26-L equipped unit.

BRAKE-PIPE LEAKAGE TEST

A brake-pipe leakage test can be performed in the following manner:

With the brake system fully charged and with the brake-valve pilot cut-out cock in the IN position, move the Automatic brake-valve handle promptly toward the SERVICE position until the equalizing reservoir pressure has been reduced 15 psi; then stop and leave the handle in this position.

As soon as the brake-pipe pressure has reduced to the level of the equalizing reservoir pressure (continuous blow from brake-valve exhaust), depress the brake-valve pilot cut-out cock handle and move it to the OUT position. Immediately observe the brake-pipe gage, and time the pressure drop in accordance with railroad rules.

At the completion of the brake-pipe leakage test, move the brake-valve handle further toward the SERVICE position and reduce the equalizing reservoir pressure slightly below the brake-pipe pressure. The brake may later be released by returning the brake-valve handle to the RELEASE position.

DEAD HEADING
(DEAD-IN-TRAIN)

1. Place the Independent brake-valve handle in the RELEASE position and the Automatic brake-valve handle in the HANDLE OFF position.

2. Depress the brake-valve pilot cut-out handle and move to the OUT position.

3. Depress the handle of the MU-2A valve and move to the LEAD or DEAD position. On units equipped with the optional double-ported cut-out cock, place the cock in the IN or OPEN position.

4. Open the dead-engine cock.

DRAINING COOLING WATER SYSTEM

For weather above freezing, the cooling water system may be drained by opening the two main water drain valves on the right side of the locomotive near the base of the lube oil cooler. (See Fig. 15.)

For freezing weather, in addition to opening the two main drain valves, remove the plug at the base of the water pump and be sure that both cab heater valves are open. (One valve is located below the operator's cab floor on most locomotive units. It may be reached from the nose cab.)

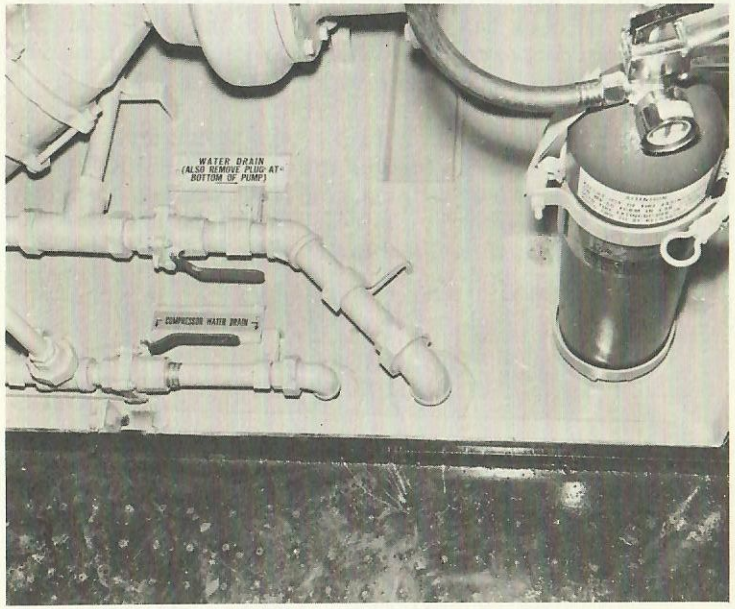
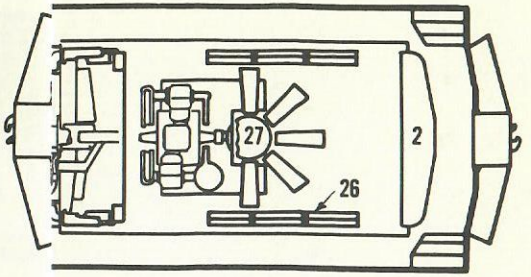
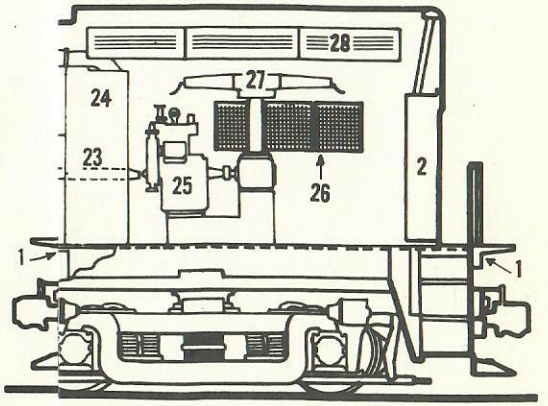


Fig. 15. Cooling-water system drain valves

Fig. 15 (E-17771)

Fig. 16 (E-17772)





NOTE: Above apparatus location is applicable to 8-cylinder engine.

Fig. 16. Four-axle-unit apparatus location (12-cylinder engine)

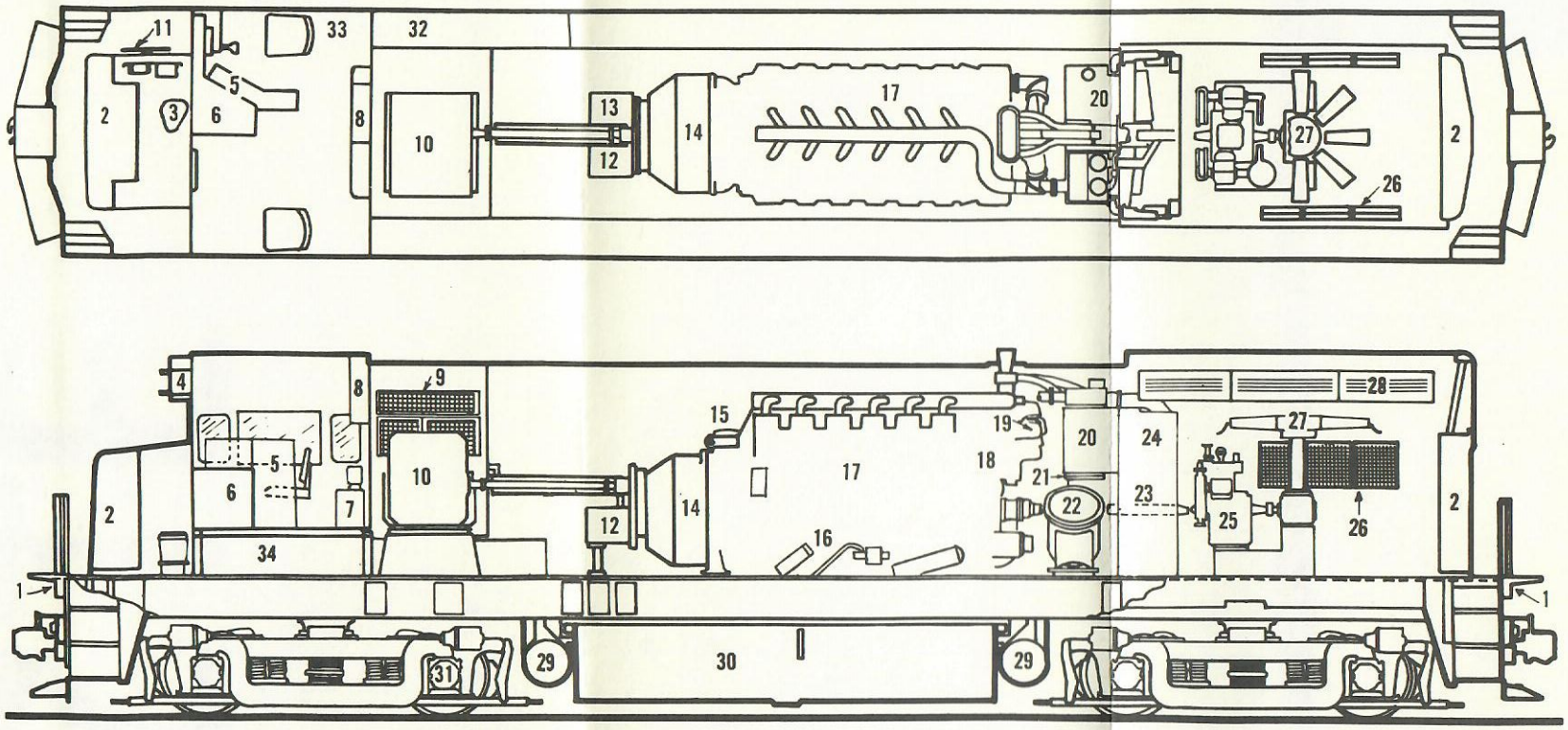


Fig. 16 (E-17772)

1 Multiple-unit connectors
2 Sand box
3 Toilet (when furnished)
4 Headlight and number boxes
5 Operating controls
6 Cab heater
7 Water cooler (when furnished)
8 Engine control panel
9 Equipment air intake
10 Equipment blower
11 Hand brake
12 Auxiliary generator
13 Exciter
14 Traction generator
15 Governor
16 Fuel-oil transfer pump and strainer
17 Diesel engine
18 Intercooler
19 Turbocharger
20 Cooling-water storage tank
21 Lube-oil cooler
22 Lube-oil filter
23 Engine air filters (inertial)
24 Engine air cleaners (panelbath or paper)
25 Air compressor
26 Dynamic brake grids (when furnish d)
27 Radiator fan
28 Radiator
29 Air reservoir
30 Fuel tank
31 Axle alternator
32 Battery (right side)
33 Air-brake equipment (right side)
34 Control-equipment compartment (left side)

NOTE: Above apparatus location is applicable to 8-cylinder engine.

Fig. 16. Four-axle-unit apparatus location (12-cylinder engine)

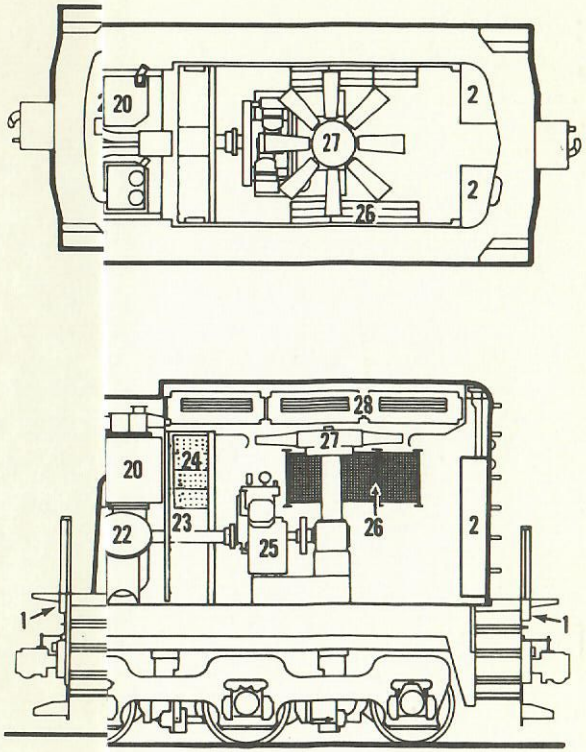


Fig. 17 (E-17773)

1 Multip
2 Sand b
3 Toilet
4 Headli
5 Operat
6 Cab he
7 Water
8 Engine
9 Ballast
10 Equipn
11 Rectifi
12 Auxilia
13 Excite
14 Tracti
15 Govern
16 Fuel-o
17 Diesel

Fig. 17. Six-axle-unit apparatus location (16-cylinder engine)

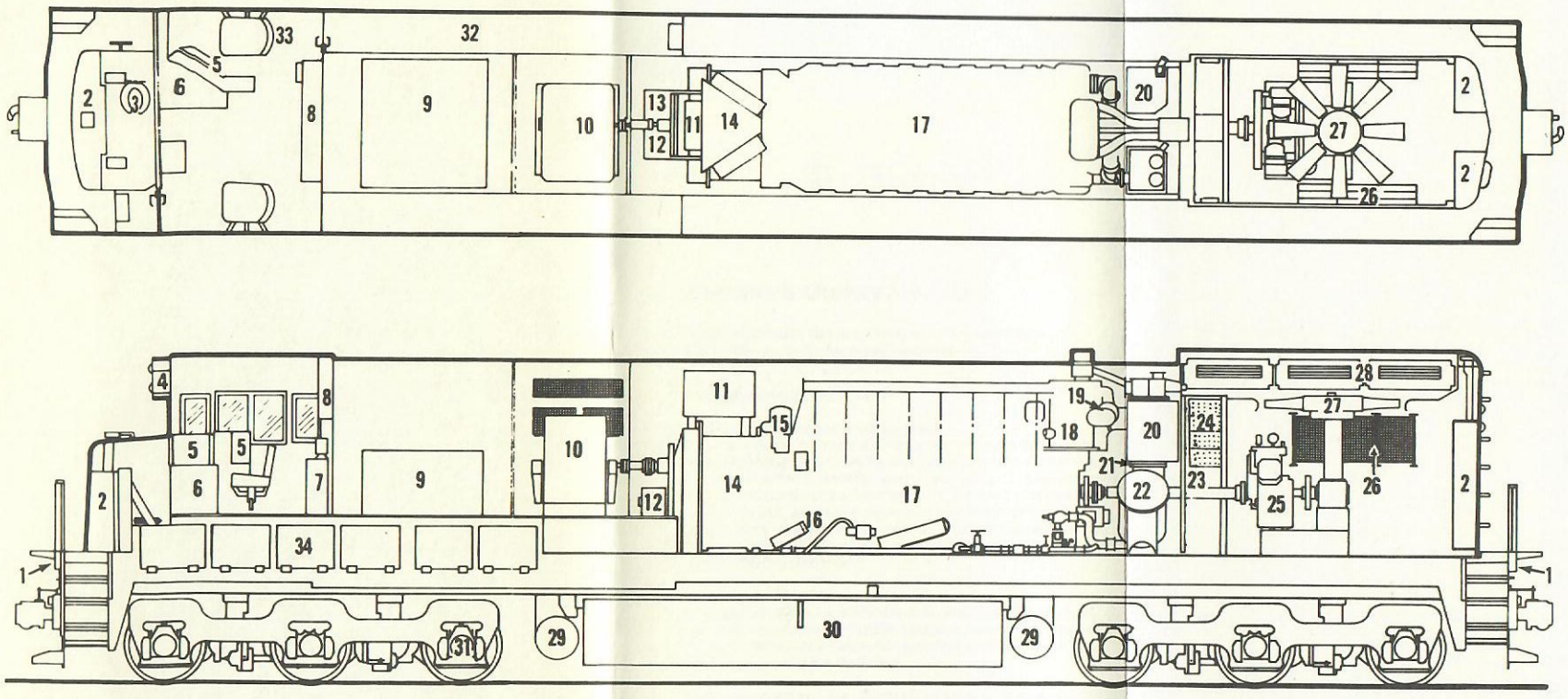


Fig. 17 (E-17773)

1 Multiple-unit connectors
2 Sand box
3 Toilet (when furnished)
4 Headlight and number boxes
5 Operating controls
6 Cab heater
7 Water cooler (when furnished)
8 Engine control panel
9 Ballast or steam generator (when furnished)
10 Equipment blower
11 Rectifier
12 Auxiliary generator
13 Exciter
14 Traction generator
15 Governor
16 Fuel-oil transfer pump and strainer
17 Diesel engine
18 Intercooler
19 Turbocharger
20 Cooling-water storage tank
21 Lube-oil cooler
22 Lube-oil filter
23 Engine air filters (inertial)
24 Engine air cleaners (panelbath or paper)
25 Air compressor
26 Dynamic brake grids (when furnished)
27 Radiator fan
28 Radiator
29 Air reservoir
30 Fuel tank
31 Axle alternator
32 Battery (right side)
33 Air-brake equipment (right side)
34 Control-equipment compartment (left side)

Fig. 17. Six-axle-unit apparatus location (16-cylinder engine)